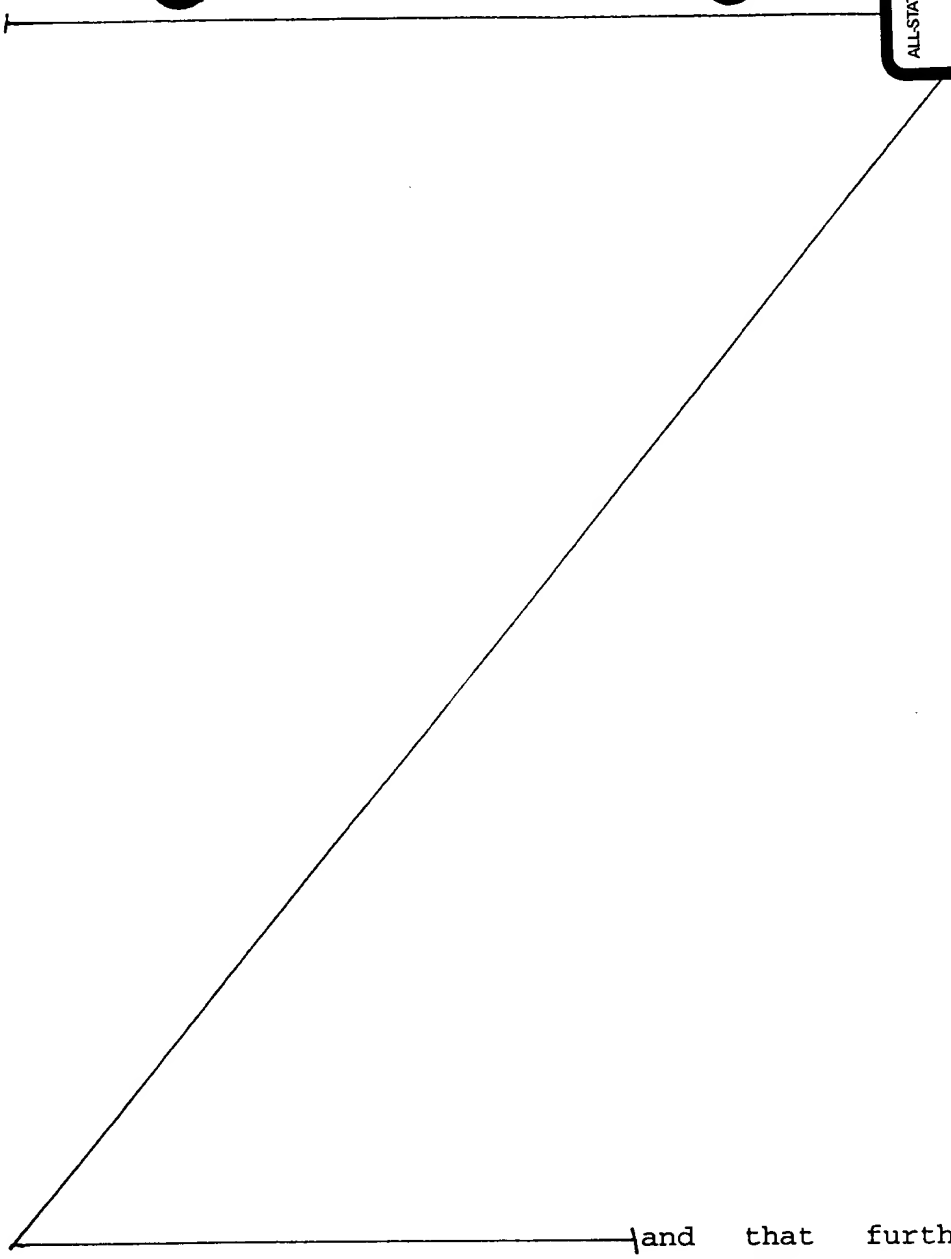

and that furthermore, errors have occurred due to coupling drift (temperature fluctuation, mismatching, or due to modem coupling), and could be taken into account only with difficulty.

DD 106 086 describes a measuring probe in which fluorescence is excited in a layer, the exciting light being directed onto the layer by a single optical fibre which surrounds, in the shape of a ring, at least one further optical fibre for fluorescent light. The fluorescent light can be measured with a detector, and the measured value thereof can be used as a measure of

the content or the concentration of a material, as a consequence of fluorescence quenching. Use is made for a reference measurement of a second optical fibre which directs fluorescent light of a layer region, which is screened from the measurement medium, onto a second detector.

However, it is not possible with this solution to ensure a concrete and accurate local assignment of the detectable fluorescence intensity over the excited layer surface, something which is, however, also necessary for accurate measurements because of an imprecisely defined local excitation or a non-defined, inhomogeneous arrangement of the fluorescing material in the layer. Moreover, an absolute optical separation is necessary for a simultaneous reference measurement or further measurements for other materials.

In addition, GB 2265711 A1 describes an optical fibre sensor in which two optical fibres inclined at a specific angle to one another are to be used. In this case, one of the optical fibres serves the purpose of sending light, and the other optical fibre serves the purpose of receiving reflected light and directing it onto a suitable detector. The alignment of the two optical fibres at an angle to one another is proposed there in order to achieve enlargement of the possible detection range of reflected light, since it is possible to achieve an enlarged overlap of the light exit cone with the light entrance cone of the two optical fibres.

US 3,992,631 describes a system and a method for carrying out fluorescence immune tests in which, inter alia, reference is made to the possibility of using different optical fibres in a bundle arrangement.

It is therefore the object of the invention to propose a device which can be of miniaturized construction and therefore be adapted flexibly to different applications and achieves a satisfactory measuring accuracy.

Patent claims

1. Device for measuring fluorescence excited by light, which has at least one layer (11, 32) which is applied to a support (14, 30) and contains a fluorescing material, having at least one light source (2) which emits light of at least one wavelength that excites fluorescence(s) in the layer(s) (11, 32), and which is directed through the support (14, 30) onto the layer(s) (11) by at least one first optical conductor (3, 15, 16, 18), the fluorescent light being directed by at least one second optical conductor (15) onto at least one detector (4) for determining the intensity of the fluorescent light, characterized in that the end faces of all the optical conductors (3, 15, 16, 20, 21, 22, 23) are arranged relative to one another, taking account of their numerical apertures and/or with reference to at least one layer (11, 32) containing a fluorescing material and being applied to the support (14, 30), and optical conductors (20, 21, 22) which are arranged as a bundle in the shape of a ring are arranged with an optical conductor (20, 22), arranged in the interior of the ring, for exciting light or for fluorescent light, or a plurality of optical conductors (3, 15, 16) are arranged in series arrangements opposite one another in pairs, such that it is possible to achieve a local assignment of the measurable fluorescence intensity, and the light source(s) (2), optical conductors (3, 15, 16, 18, 20, 22, 31, 33) and the detector(s) (4, 5) are held in a measuring head (1).

2. Device according to Claim 1, characterized in that at least the part of the measuring head (17) which holds the outer end(s) of the optical conductors (3, 15, 16, 18) is/are of flexible construction.

3. Device according to Claim 1 or 2, characterized in that the upper measuring head region (17) is at least partially bent.

4. Device according to one of Claims 1 to 3, characterized in that a filter (7, 8), a system of exchangeable filters and/or a launching optical system (20) is/are arranged in each case between the light source (2) and optical conductor (3, 18) and/or between the detector (4) and optical conductor (15, 18).

5. Device according to one of Claims 1 to 4, characterized in that a plurality of optical conductors (20, 21, 22) are arranged in the shape of a ring, a circular arc and/or a star on the measuring head end (17) pointing towards the fluorescing layer(s).

6. Device according to Claim 5, characterized in that optical conductors (20) for exciting light and reference light (21) or a further fluorescent light are arranged in an alternating fashion in an outer ring, and optical conductors (22) for fluorescent light are arranged in an inner ring.

7. Device according to one of Claims 1 to 6, characterized in that the optical conductors (3, 15, 16, 20, 21, 22) for exciting light, fluorescent light and reference light or a further fluorescent light are inclined at different angles with their ends pointing towards the fluorescing layer.

8. Device according to one of Claims 1 to 7, characterized in that there is arranged on the upper measuring head region a heater (12) having a temperature sensor (13) and a controller or regulator which is arranged in the measuring head and maintains a prescribable temperature at the fluorescing layer(s) (11) and/or at the upper measuring head region (17).

9. Device according to one of Claims 1 to 8, characterized in that the support (30), which is transparent to the exciting light and fluorescent light, has at least partially polished or reflecting surface regions (36, 37) and/or is surrounded there by a medium of lower refractive index, and is mounted in an exchangeable fashion on the measuring head (1).

10. Device according to Claim 9, characterized in that the exciting light is launched into the support

(30) with the aid of at least one optical conductor (31) such that the exciting light is totally reflected at least in the region of the layer (32), and damped total reflection occurs.

11. Device according to Claim 9 or 10, characterized in that the support (30) is constructed in an elongated fashion in a plane.

12. Device according to Claims 9 to 11, characterized in that the support (30) is subdivided along its longitudinal axis into a plurality of regions (30.1, 30.2, 30.3).

13. Device according to Claims 9 to 12, characterized in that on the end face opposite its end face into which the exciting light can be launched, the support (30) has an angular surface and a layer (32) which contains a fluorescing material and at which the exciting and fluorescent light is reflected in the direction of a planar optical conductor (35) constructed symmetrically relative to the support (30), and the light from the angular surface thereof is directed onto an end face arranged at the other end of the optical conductor (35), and from there at least fluorescent light is directed onto a detector (4) via at least one optical conductor (15), the support (30) and planar optical conductor (35) being arranged at a spacing from one another and/or being optically separated as far as into the region of the angular surfaces.

14. Device according to Claims 9 to 13, characterized in that the support (30) is of u-shaped construction, the two limbs (30', 30'') are arranged at least partially spaced apart and/or are optically separated from one another, and the exciting light can be launched into an end face of a limb (30') via at least one optical conductor (31), and at least fluorescent light can be coupled out via the end face of the other limb (30'') into at least one further optical conductor (33).

15. Device according to Claim 14, characterized in that the two limbs (30', 30'') of the u-shaped support (30) are connected in the shape of a bow, a wedge or a cone, or by means of an angular web (30''').

16. Device according to one of Claims 1 to 14, characterized in that heating elements (12) and/or temperature sensors (13) are integrated or can be introduced into the support (30).

17. Device according to one of Claims 1 to 16, characterized in that between an optical conductor for fluorescence-exciting light and a layer (32) containing fluorescing material, a transparent body (40) made from an optically scattering material is arranged, or a diffusely scattering surface pointing to the layer (32), is constructed or arranged on the body (40).

18. Device according to Claim 17, characterized in that the body (40) is formed from optically transparent material which contains light-scattering particles and/or is wavelength-selective.

19. Device according to one of Claims 1 to 18, characterized in that at least one further optical conductor (16) directs reflected light onto a further detector (5) for detecting a reference signal.

20. Device according to one of Claims 1 to 19, characterized in that the upper heated region is thermally insulated with respect to the lower region, in which the light source(s) (2) and the detector(s) (4, 5) are held.

21. Use of a device according to one of Claims 1 to 20 for detecting fluorescence-quenching, fluid materials.